ND-SR ISOTOPE SIGNATURES OF IMPACTITES FROM THE POPIGAI IMPACT CRATER (RUSSIA); Th. Hölker[1], A. Deutsch[1], and V.L. Masaitis[2]; [1]Inst. f. Planetologie, Wilhelm-Klemm-Str. 10, D-48149 Münster, Germany (e-mail <deutsca@uni-muenster.de>); [2]Karpinski Geol. Inst., Sredni Prospekt 74, St. Petersburg, 199026 Russia (e-mail <vsg@sovam.com>)

Summary. We report Sr-Nd isotope parameters for impactites from the 100 km sized Popigai impact crater, Sibiria. One tagamite whole rock sample, and six impact melt glass samples, separated from breccias show present day ε_{Sr} between +351 and +395 and ε_{Nd} of about -23.5; the model ages in [Ga] are: T^{Sr}_{UR} about 2.1, and T^{Nd}_{DM} about 2.2. Three gneiss whole rocks, display much more variations in ε_{Sr} and ε_{Nd}, and slightly higher T^{Nd}_{DM} model ages of 2.4 Ga. Glassy ejecta material in Late Eocene deposits in the Western hemisphere has distincly different isotope parameters, ruling Popigai out as source crater.

Introduction. Popgai is a 100 km sized impact crater on the northeastern slope of the Anbar Shield in Northern Siberia (N71° 30', E111° 0'). Popgai is not only known for its excellent state of preservation [1, 2] but also as type locality for impact diamonds [3]. Published ages for Popigai impactites range from 30 up to 70 Ma, the most precise ^{40}Ar-^{39}Ar data (35.7 Ma ± 5 Ma, 2σ [4]), however, indicate an origin in the Late Eocene. Despite this rather uncertain age, Popigai has recently been suggested as possible source of shocked quartz in an Ir-enriched ejecta horizon of Upper Eocene age in the Massignano section, Italy [5, 6]. Late Eocene distal impact debris and PGE anomalies occur at several localities, *i.e.*, Antarctica (Maud rise, ODP site 689B [6]); offshore New Jersey, DSDP 612 [*e.g.*, 7]; Carribean Sea, Barbados, and the Gulf of Mexico [*e.g.*, 8, 9]). In addition, the tektites of the North American strewn field belong to this age group [*e.g.*, 9, 10]. The distinctive Sr, Nd isotope characteristics of tektites and microtektites help to constrain age and characteristics of the target, from which the material originated by impact melting [7, 8, 10]. On the basis of the source characteristics, which can be derived from Sr, Nd model parameters [10], tektites and microtektites of the North American strewn field have been correlated [11] with the about 35 Ma Chesapeake Bay crater off the Virginia coast [12]. In this report, we present the first correlated Sr-Nd isotope data for impactites from Popigai. These data may help to identify distal ejecta of the Popigai event. In addition, they can be used to separate the horizons with impact debris produced by two large craters, Popigai and Chesapeake Bay, which probably are closely related in time.

Samples and analytical procedures. We have analysed one tagamite whole rock (# 1284/91.9), six bulk samples of impact melt glass, separated from various breccias (specimen # 8-78/7, 6459d; 8-616; 4602/88-89; 8-620; 4602/36) and three gneiss whole rock samples. These are 1320/65, a garnet gneiss from the ring uplift, 7232a, a leucocratic garnet-biotite gneiss (inclusion in a suevite), and 132a, a plagiogneiss from the crater rim. The impact melt rocks were crushed and coarser rock fragments as well as the alteration crust (if present) removed. Under the microscope, however, tiny mineral clasts are still visible, amongst them ballen quartz. All samples were cleaned in an ultrasonic bath and totally spiked with mixed tracers prior to solution. See [13] for further analytical details.

Results. Sr, Nd isotopic parameters of the tagamite and the melt glasses are quite homogenous. ε_{Sr} range from +351 to +395, ε_{Nd} cluster at -23.5 (Fig. 1).The mean model ages ± 1σ_D (n=7) for the melt lithologies are T^{Sr}_{UR} = 2.07 ± 0.05, T^{Nd}_{CHUR} 1.95 ± 0.02, and T^{Nd}_{DM} 2.21 ± 0.02 (Tab. 1). Sr model ages slightly exceed T^{Nd}_{CHUR} ages but are lower than Nd model ages calculated for the depleted mantle model. The data indicate that impact melts in the Popigai structure preferentially originated from materials added in Proterozoic times to the continental crustal, and from sediments, derived from this crust. The data for the three gneisses scatter in the ε_{Sr} *vs.* ε_{Nd} diagram of Fig. 1. Results for samples 7232a, and 132a imply an open system behaviour for Rb-Sr. The mean T^{Nd}_{DM} age for the three gneiss specimen is 2.43 ± 0.05 (1σ_D), which is higher than the T^{Nd}_{DM} age for melt rocks, yet in better accordance with the Archean age proposed for Anbar Shield lithologies. We want to emphasise that Sm, Nd concentrations in the melt lithologies can not be modelled from those in the gneiss samples, indicating a rather biased sampling (not in the field but from our collection).

Discussion. The new Sr, Nd data, especially the close range of model ages, yield isotope geochemical restrictions for interpreting Popigai as the parent crater of distinct ejecta material. So far, none of the analysed, about 35 Ma tektites and microtektites [7, 8, 10] match in their isotope characteristics the Popigai material, corroborating the view of [11]. To better characterise the target at Popigai, additional

ND-SR ISOTOPE SIGNATURES: HÖLKER TH. et al.

analyses are necessary, and precise dating is mandatory. Finding melt particles at Massignano would finally allow to relate this ejecta horizon to the Popigai event.

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TABLE 1: Rb-Sr, Sm-Nd isotopic data and model parameters. Sample weight for TI-MS analyses was 83 to 116 mg

sample	*Rb [ppm]*	*Sr [ppm]*	$^{87}Sr/^{86}Sr^{1}$ $\pm 2\sigma_m$	*Sm [ppm]*	*Nd [ppm]*	$^{143}Nd/^{144}Nd^{2}$ $\pm 2\sigma_m$	ε_{Sr}	ε_{Nd}	T^{Sr}_{UR} [Ga]	T^{Nd}_{CHUR} [Ga]	T^{Nd}_{DM} [Ga
1284/91.9	84.41	242.3	0.732355±21	6.878	41.13	0.511383± 8	395.4	-24.5	2.08	1.99	2.25
8-78/7	82.54	262.9	0.729243±24	7.348	42.95	0.511449±10	351.2	-23.2	2.08	1.94	2.21
6459d	80.94	243.1	0.730445±21	6.659	39.01	0.511460± 8	368.3	-23.0	2.04	1.92	2.19
8-616	91.26	265.9	0.730551±25	7.638	44.85	0.511433±12	369.8	-23.5	1.98	1.95	2.22
4602/88-89	85.22	272.6	0.729827±22	7.665	44.75	0.511434± 9	359.5	-23.5	2.13	1.96	2.23
8-620	85.77	275.5	0.729244±25	7.660	44.80	0.511460±10	351.2	-23.0	2.09	1.92	2.19
4602/36	85.85	276.7	0.729255±24	7.685	44.93	0.511448± 8	351.4	-23.2	2.10	1.94	2.21
1320/65	162.7	315.8	0.745805±29	5.766	27.07	0.511733± 8	586.3	-17.7	2.03	2.02	2.36
7232a	60.60	332.3	0.721553±28	1.602	11.03	0.511034± 9	242.1	-31.3	2.64	2.24	2.44
132a	4.419	209.5	0.705296±20	1.260	5.576	0.511790±10	11.30	-16.5	-2.64	2.14	2.49

1 normalized to $^{86}Sr/^{88}Sr = 0.1194$; 2 normalized to $^{146}Nd/^{144}Nd = 0.7219$. For definition of εSr, T^{Sr}_{UR}, εNd, and T^{Nd}_{CHUR}, see [3], and for T^{Nd}_{DM}, see [8]. Errors in εSr, and εNd are about ±1, and ≤ ± 0.8 ε-units.

FIG. 1: ε_{Sr} *vs.* ε_{Nd} for Popigai impactites analysed in this work ("target rocks", "tagamites"), compared to data by [7, 8, 10] for tektites and microtektites of the North American strewnfield (light symbols).